

AMENDMENT UNDER 37 C.F.R. §1.111
U.S. APPLN. NO. 10/148,214

REMARKS

Applicant has made some minor editorial amendments to pages 1, 3 and 7 of the specification.

Applicant notes the allowability of claim 18 (18/11), and has rewritten this claim as a new independent **claim 23** which now should be **allowed**.

Applicant also has added a new dependent claim 22 which is dependent on claim 21 and which contains the limitation of allowable claim 18, whereby claim 22 also now should be **allowed**.

Applicant respectfully traverses the rejection of claims 11-17 and 19-21 under 35 U.S.C. § 103(a) as being unpatentable (obvious) over Yang (EP 798844) in view of **newly cited** Lamb (US 5,834,872), and submits that these rejected claims and new claims 22 and 23 are allowable.

Applicant's independent **claim 11** is directed to a continuously variable electromagnetic transmission including a commutator-less, axial flux dynamoelectric machine including three main assemblies, namely a stator assembly and two rotors, said two rotors and the stator assembly comprising discoid elements. Discoid elements of the stator assembly and of at least one of the rotors comprise electrical active elements arranged to interact with the other rotor by means of magnetic flux through axial air gaps between respective discoid elements of the three assemblies. According to claim 11, as amended, the transmission includes displacement means for axially displacing at least one of the discoid elements to modify the width of the axial air gap between two interacting discoid elements, one of which is an active element having windings connected to the control means that can supply electric power at a variable frequency.

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The present invention thus provides for the combination of a variation of the axial air gap with a variation of the variable supply frequency (by control unit 21 shown in Fig. 1) to allow a control of the magnetic field in the axial air gap during operation, particularly when the relative speeds vary, thus permitting to optimization of the efficiency of the transmission, as explained in Applicant's specification on page 7, third and fourth paragraphs.

Furthermore, if desired, the axial displacement can produce a mechanical coupling of the two rotors, as specified in **claim 20** and described in the paragraph bridging pages 7 and 8 of the specification.

The scope of the independent **claim 21** is substantially the same as that of claim 11, except for the shape of the interacting elements, which is not necessarily a discoid shape provided there is an axial flux through an axial air gap.

The Examiner considers that Yang discloses a transmission having the features set forth in the first paragraph of claims 11 and 21, respectively, but fails to teach that such transmission might include displacement means for axially displacing at least one of the interacting elements to modify the width of the axial air gap between said element and an adjacent interacting element.

However, Applicant cannot find in Yang's disclosure any suggestion that the active elements of the transmission, i.e., the elements having windings connected to control and powering means, might be energized by electric power at a variable frequency. The passage (col. 8, lines 12-15) cited by the Examiner in this connection on page 2 of the Office Action is:

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"If the field excitation winding for electromechanical effect mutual driving with the electrical machine rotor is provided to generate rotational magnetic field, ..."

Applicant agrees that an electric power supply for generating a rotational field generally has a frequency, but **nothing** in that passage discloses or even suggests supply of electric power at a variable frequency in Yang's transmission.

Yang thus fails to disclose two substantial features which allow the magnetic field to be adjusted within an air gap as a function of the desired operating conditions in a transmission according to claim 11 or 21, namely:

- i) displacement means for modifying the width of the axial air gap between two interacting elements, and
- ii) control means for varying the frequency of the electric supply to an active one of said two interacting elements.

Furthermore, Applicant respectfully submits that the Examiner's reference to Figs. 30&30-1 of Yang's disclosure is not appropriate, because the embodiments shown in those drawings have no stator assembly, all elements being rotary. Instead, reference could be made to Figs. 9-11 each showing a fixed element (i.e. a stator) in the transmission (see e.g. col. 21, lines 50-52).

Lamb '872 discloses an adjustable magnetic coupler arranged for varying the width of axial air gaps 48, 48' between permanent magnets 46 of a pair of first disk-shaped rotors 24, 25 and conductor rings 28, 29 of a pair of second disk-shaped rotors 26, 27, wherein a push-pull

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means is provided to move axially the first rotors to vary the width of the air gaps. Applicant notes that the rotors of Lamb's coupler do not have any active element in the sense of the present invention, i.e., elements having windings electrically connected to control and powering means.

It is, thus, clear that Lamb's magnetic coupler is not an electromagnetic transmission apparatus, but an apparatus wherein the torque is transmitted only by passive elements, such that it belongs to a type of transmission devices that is fundamentally different from the subject matter of the present invention, belonging to the category of dynamoelectric machines. Hence, a skilled person aiming to improve the operating conditions of the electromagnetic interactions between elements of a dynamoelectric machine would not obviously have considered the teachings of Lamb's disclosure. This is a first reason why the subject matter of claims 11 and 21 is patentable over Yang in view of Lamb.

In col. 2, lines 20-23, Lamb discloses that gap adjustment varies the rotational slip between the magnet (first) rotor units and the conductor (second) rotor units for a given torque load and hence effects the speed of the load. However he neglects therein a very important effect: in such a coupler, the transmissible torque is decreased so sharply with an increase of the gap width that it will readily fall under the torque load, such that rotation of the load will tend to stop.

The present invention as defined in **claim 11** or in **claim 21** overcomes such drawbacks because the variation of the width of an axial air gap is made between interacting elements one of which is an active element connected to the control means. Thus, one can advantageously

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control a variation of the supply frequency in conjunction with a variation of the air gap in order to improve the operating condition.

Any obvious (or non-obvious) combination of Lamb's teachings with a transmission of the kind taught by Yang would fail to comprise feature (ii) mentioned above, i.e. means for varying the frequency of the electric current in the active element.

Hence, no combination, either obvious or not, of Yang's and Lamb's respective disclosures would or could lead to the subject matter of claims 11 or 21.

In the Office Action, the Examiner has based the rejection of **claims 15 and 16** upon the assertion that various numbers of rotors are taught by Yang, e.g., in col. 69, lines 23-32, noting that the "common magnetic pole" 101 (Fig. 1) is located between inner and outer layer armatures 102 and 103. Applicant notes that said armatures 102 and 103 are separate rotors, armature 102 being connected to the output shaft and armature 103 being connected to the input shaft. Hence, the subject matter of each of claims 15 and 16, relating to combinations of respective stator and rotor elements, is **not** even suggested by any combination of Yang's disclosure with Lamb's teachings, and, thus, is patentable per se.

Claims 12-17 and 20 should be considered allowable over Yang and Lamb as depending on the allowable claim 11.

Applicant also respectfully traverses the rejection of **claims 11-17 and 20-21** under 35 U.S.C. § 103(a) as being unpatentable (obvious) over Schroedl (WO 99/39426) in view of Lamb (US 5,834,872).

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For the Examiner's information, Applicant encloses a copy of US Patent No. 6,373,160 which is an English-language equivalent of Schroedl's published International application (WO '426).

Schroedl discloses an electromagnetic transmission having most of the features set forth in the first paragraph of claims 11 and 21, respectively. However, it is not clear whether Schroedl's machine is really of a continuously variable type. Fig. 5 is said to show a transmission with variable speed ratio, but the variation is obtained by switching between two fixed frequencies for supply to the active element. Hence, Applicant believes that such transmission is not "continuously variable".

However, in any event, Schroedl fails to disclose or suggest two substantial features allowing the desired operating conditions to be attained in a transmission according to claim 11 or 21, namely:

- i) displacement means for modifying the width of the axial air gap between two interacting elements, and
- ii) at least one of the rotors comprises an active element having windings connected to said control means.

Applicant has demonstrated above that Lamb's magnetic coupler is not an electromagnetic transmission apparatus but, rather, an apparatus wherein the torque is transmitted only by passive elements, such that it belongs to a type of transmission devices that is fundamentally different from the subject matter of Applicant's invention, belonging to the category of dynamoelectric machines. Hence, a skilled person, aiming to improve the operating

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conditions of the electromagnetic interactions between elements of a dynamoelectric machine like Schroedl's machine, would not obviously have considered the teachings of Lamb's disclosure. For that reason, the subject matter of claims 11 and 21 is patentable over Schroedl in view of Lamb.

Furthermore, since neither Schroedl nor Lamb discloses or even suggests provision of active elements in at least one of the rotors, in particular for varying the field by means of a variable frequency electric supply, no combination, either obvious or not, of Schroedl and Lamb's respective disclosures would or could lead to the subject matter of claims 11 or 21.

Claims 12-17 and 20 should be considered allowable over Yang and Janson as depending on the allowable claim 11.

Moreover, Applicant notes that the subject matter of amended **claim 20** is not suggested by any combination of Schroedl's disclosure with Lamb's teachings, and, thus, is patentable per se. No ground for rejection of claim 20 over a combination of these references has been set forth in the Office Action. Furthermore, regarding the Examiner's statement in the third paragraph of page 4, "the adjustment of the air gap in Lamb could include an adjustment such that the air gap distance was zero", Applicant respectfully submits that this statement could be based only on the prohibited use of **hindsight** interpretation of Lamb's disclosure. Such interpretation would certainly not be invoked in combination with Schroedl, because Schroedl does **not** suggest **any** possibility of mechanical connection between the rotors.

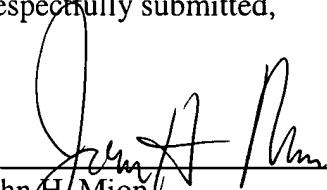
In summary, Applicant respectfully submits that the application now is in condition for allowance with all of claims 1-23 (new claim 22 being equivalent to the allowable claim 18/1).

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However, if for any reason the Examiner feels that the application is not now in condition for allowance, the Examiner is respectfully requested to **call the undersigned attorney** to discuss any unresolved issues and to expedite the disposition of the application.

Applicant files concurrently herewith a Petition (with fee) for an Extension of Time of Two Months. Applicant hereby petitions for any extension of time which may be required to maintain the pendency of this application, and any required fee for such extension is to be charged to Deposit Account No. 19-4880. The Commissioner is also authorized to charge any additional fees under 37 C.F.R. § 1.16 and/or § 1.17 necessary to keep this application pending in the Patent and Trademark Office or credit any overpayment to said Deposit Account No. 19-4880.

Respectfully submitted,


John H. Mion
Registration No. 18,879

SUGHRUE MION, PLLC
2100 Pennsylvania Avenue, N.W.
Washington, D.C. 20037-3213
(202) 663-7901

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